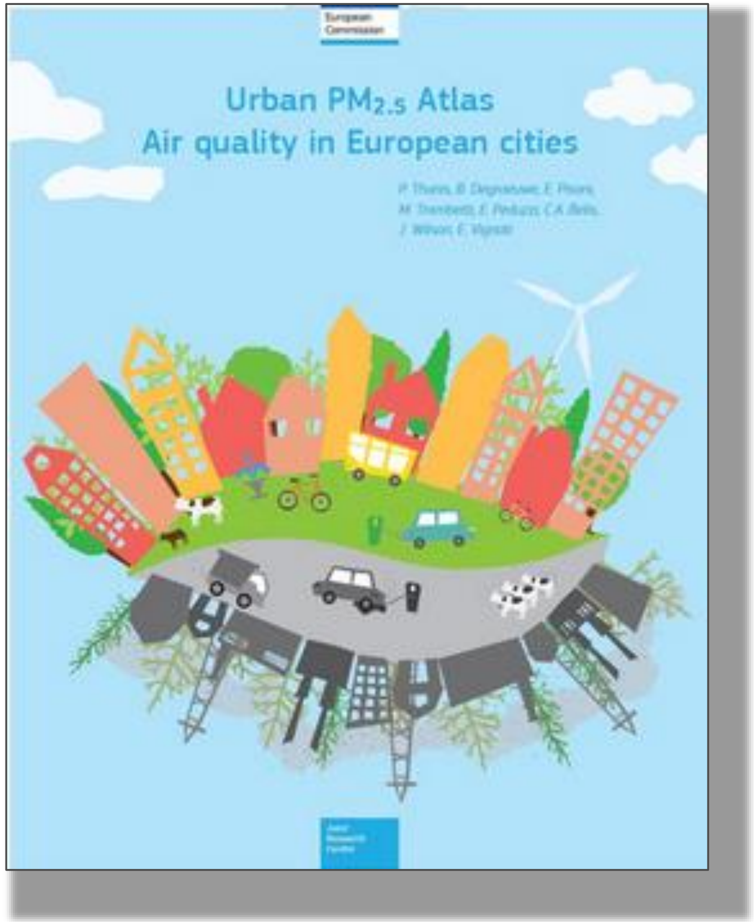
European Commission

The 2021 Urban PM2.5 Atlas
Are cities responsible for their air pollution?

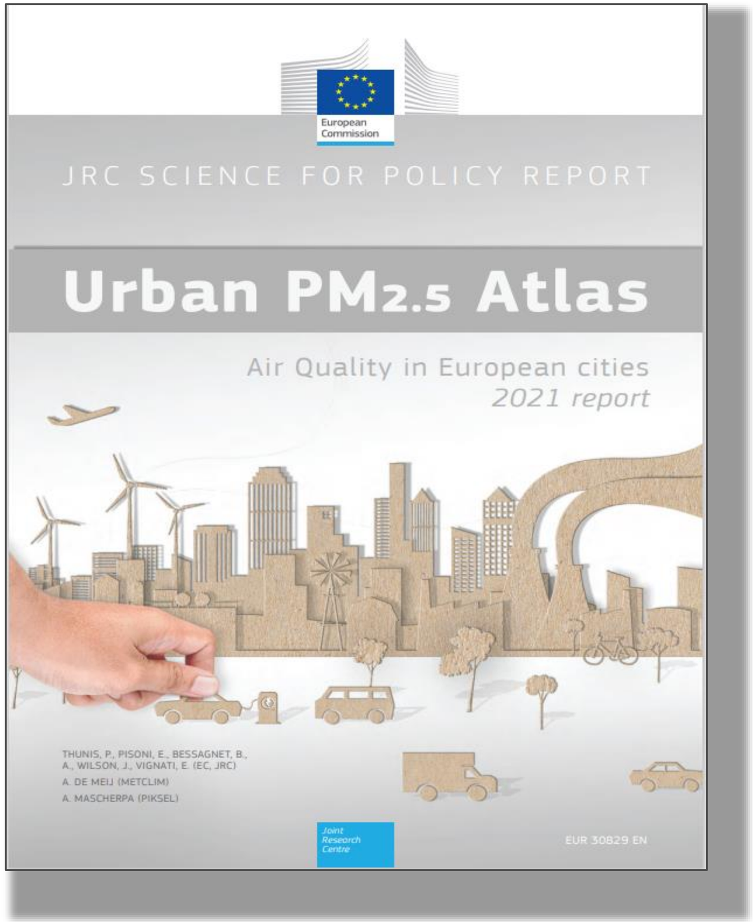
P. Thunis, E. Pisoni

EPCAC, Nov 29th 2021

Joint Research Centre



2017



https://publications.jrc.ec.europa.eu/repository/handle/JRC126221

2021

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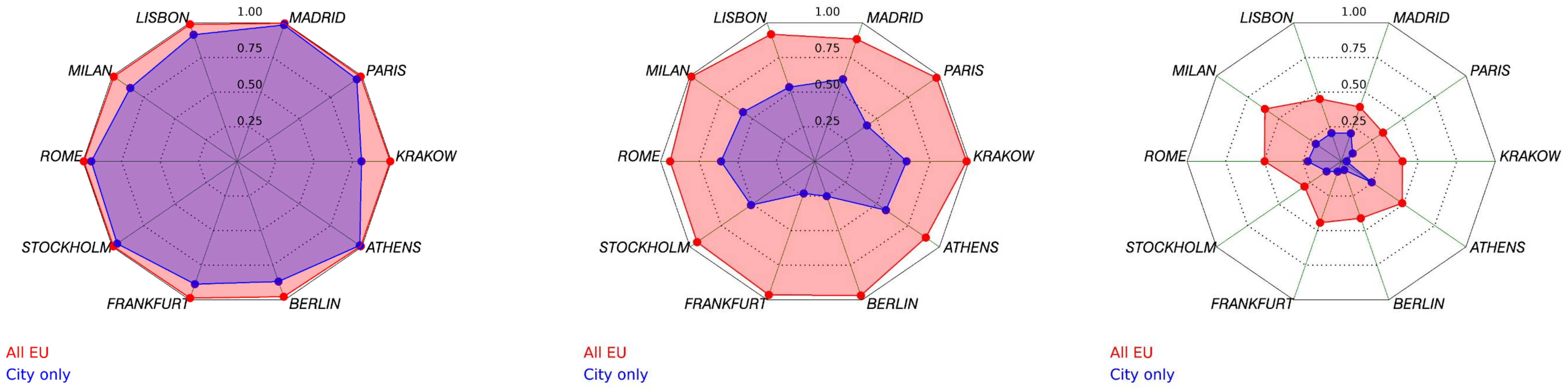
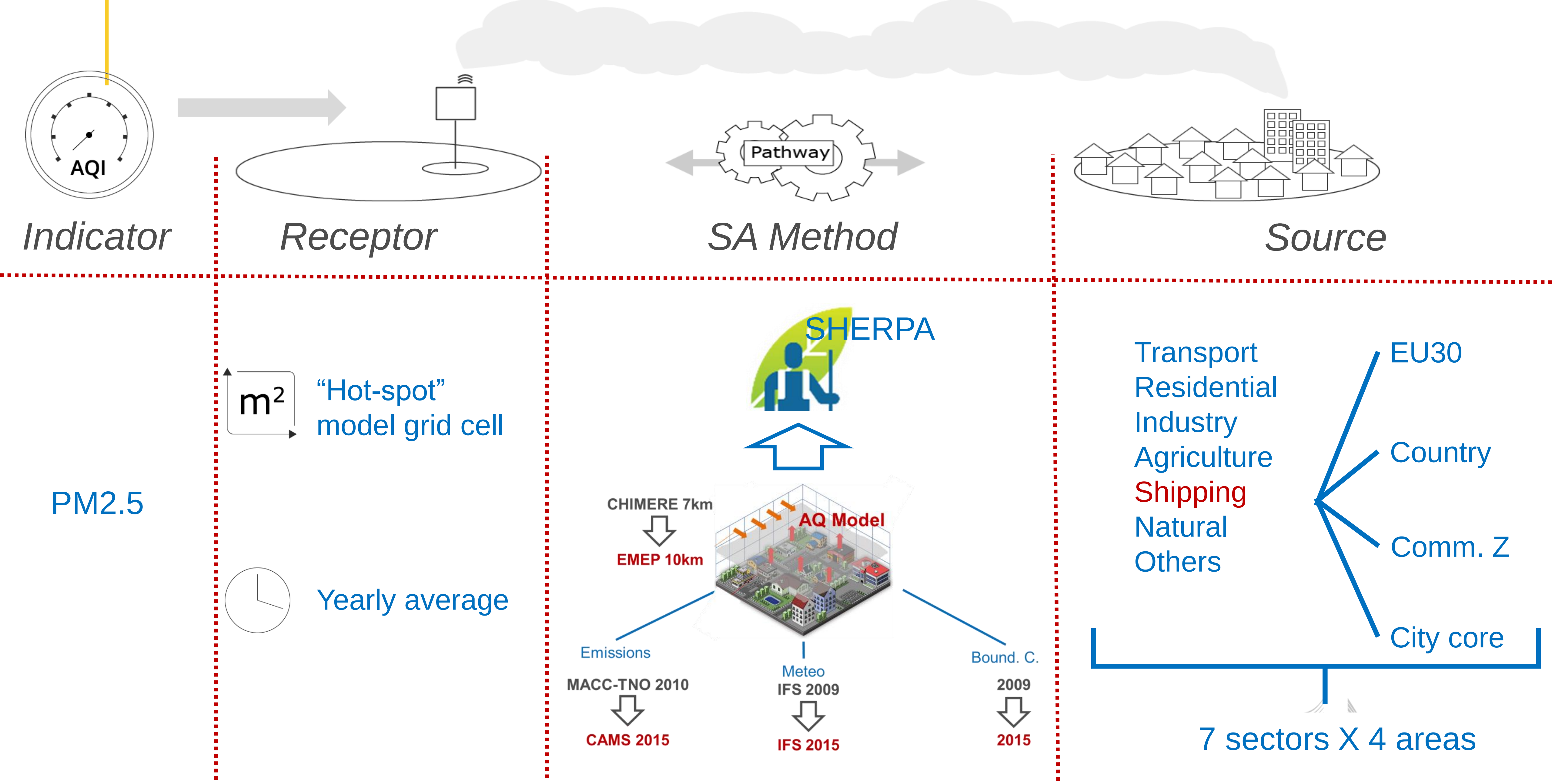
$PM_{2.5}$: a particular pollutant

Yearly average NO_2 | Yearly average $PM_{2.5}$ | Summer 8h daily max O_3



- Receptor: hot spot location, year/season
- Source: city FUA
- Method: EMEP BF100%

Atlas 2021 vs. Atlas 2017

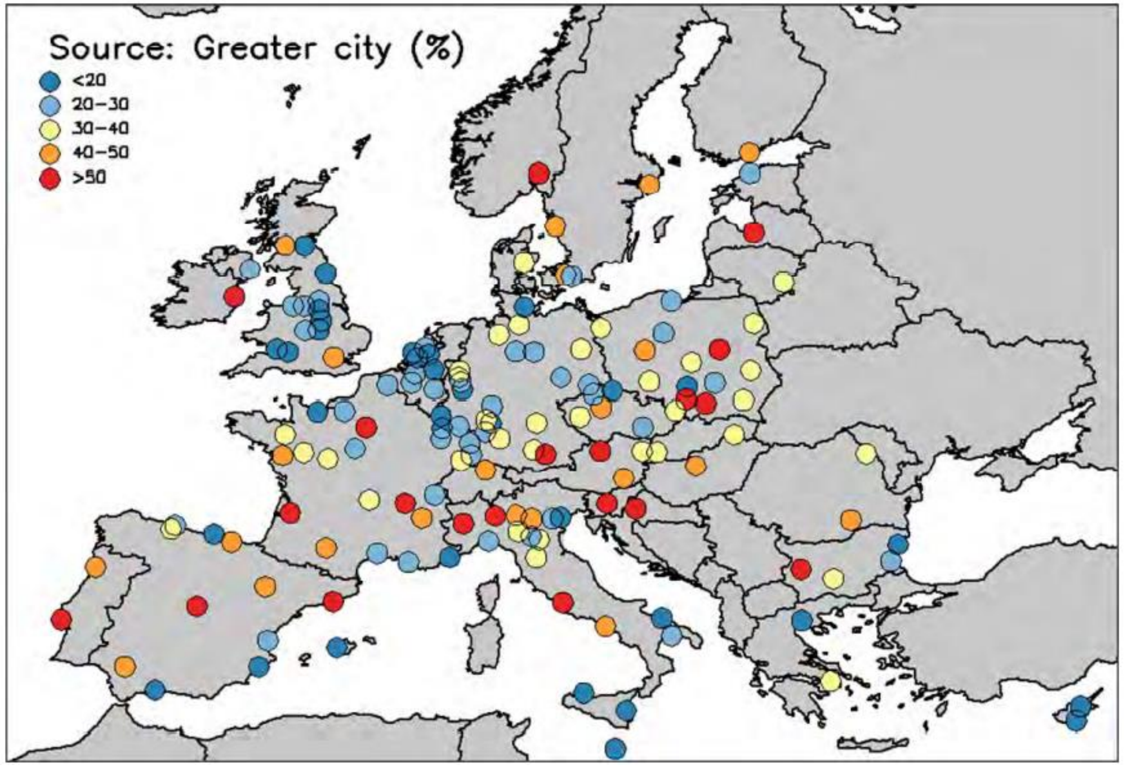


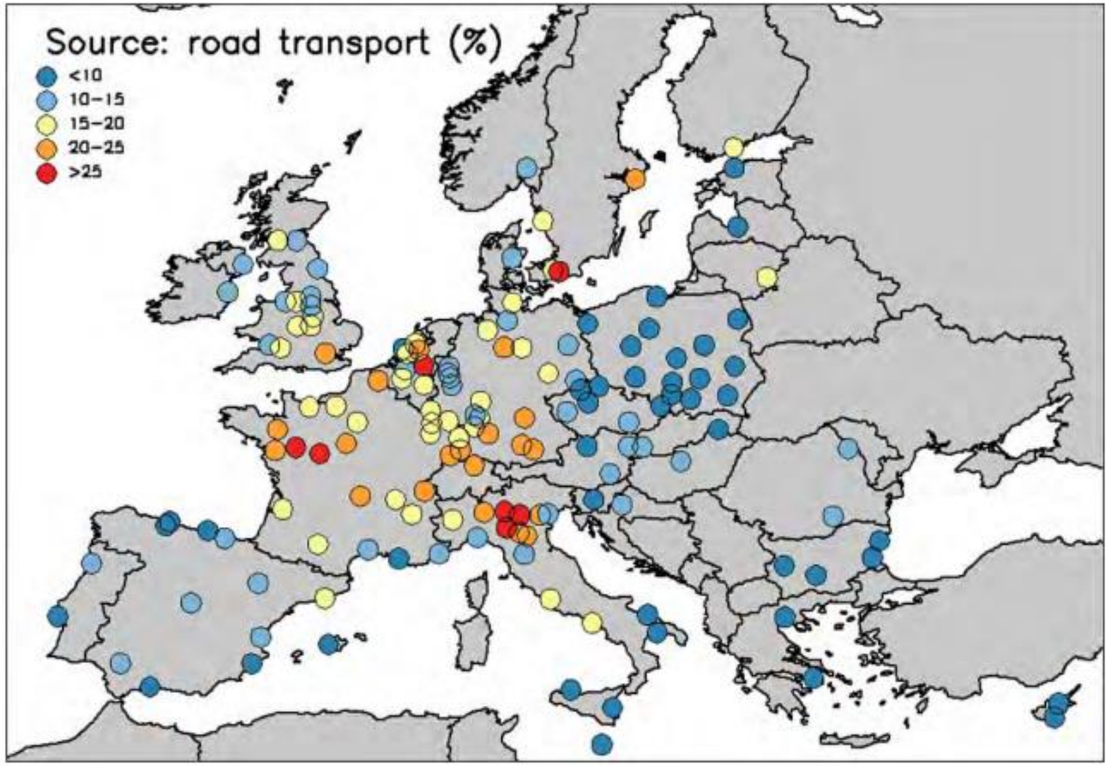
Two main visualizations

1. **All** cities – **One** source (sector or spatial) → Overview maps & rankings

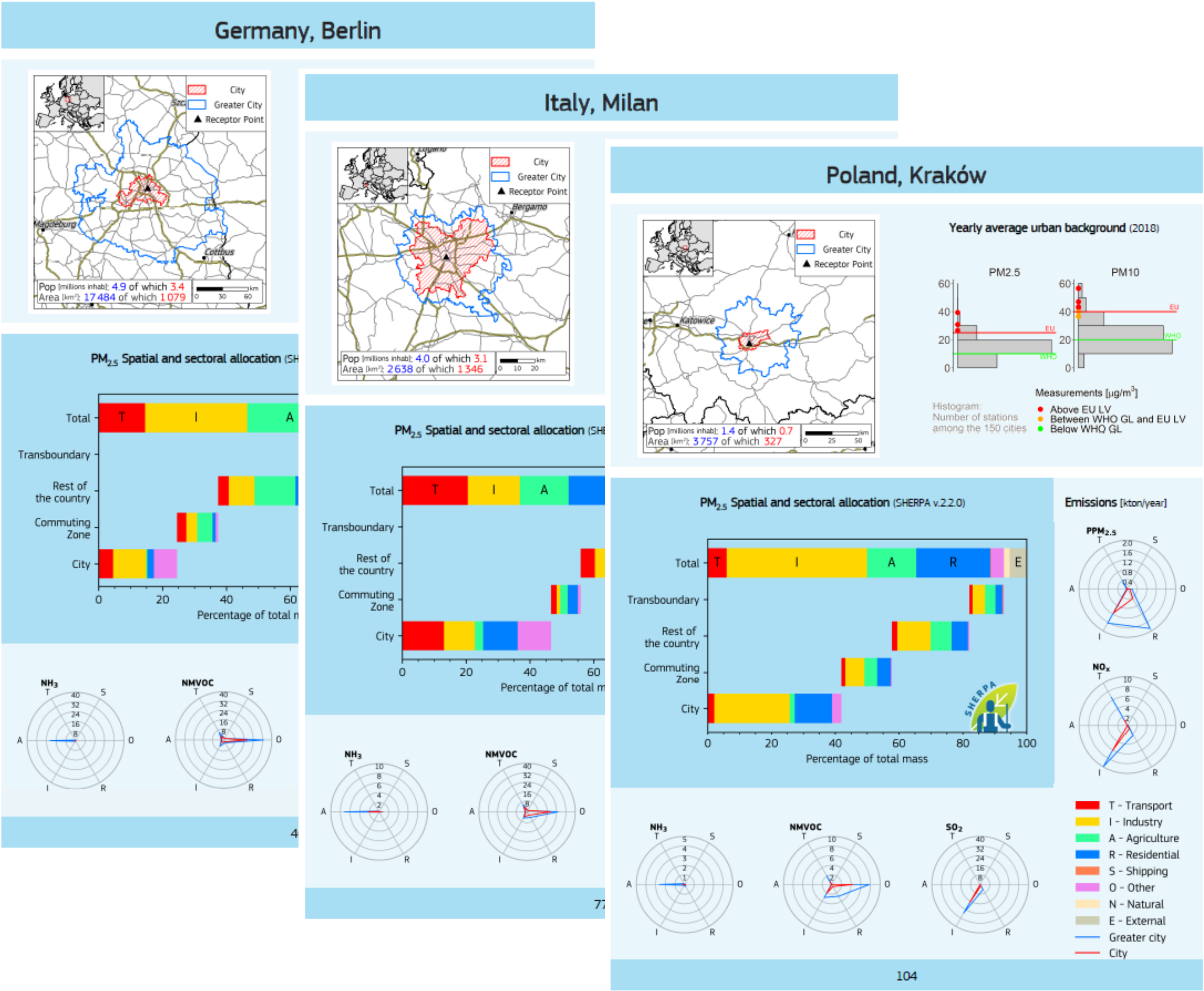
2. **One** city - **All** sources (sectors and spatial) → City Fiches

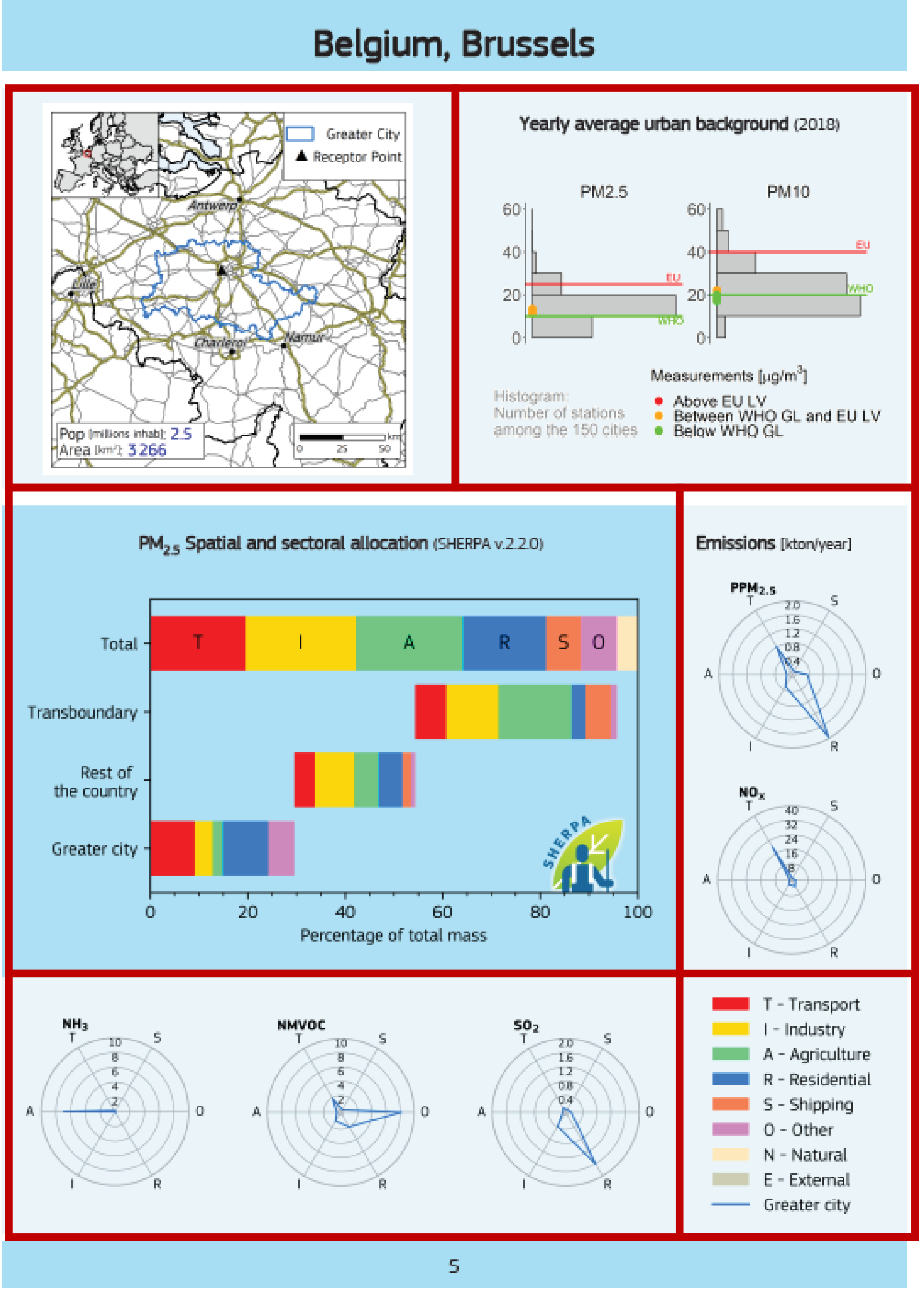
Overview maps



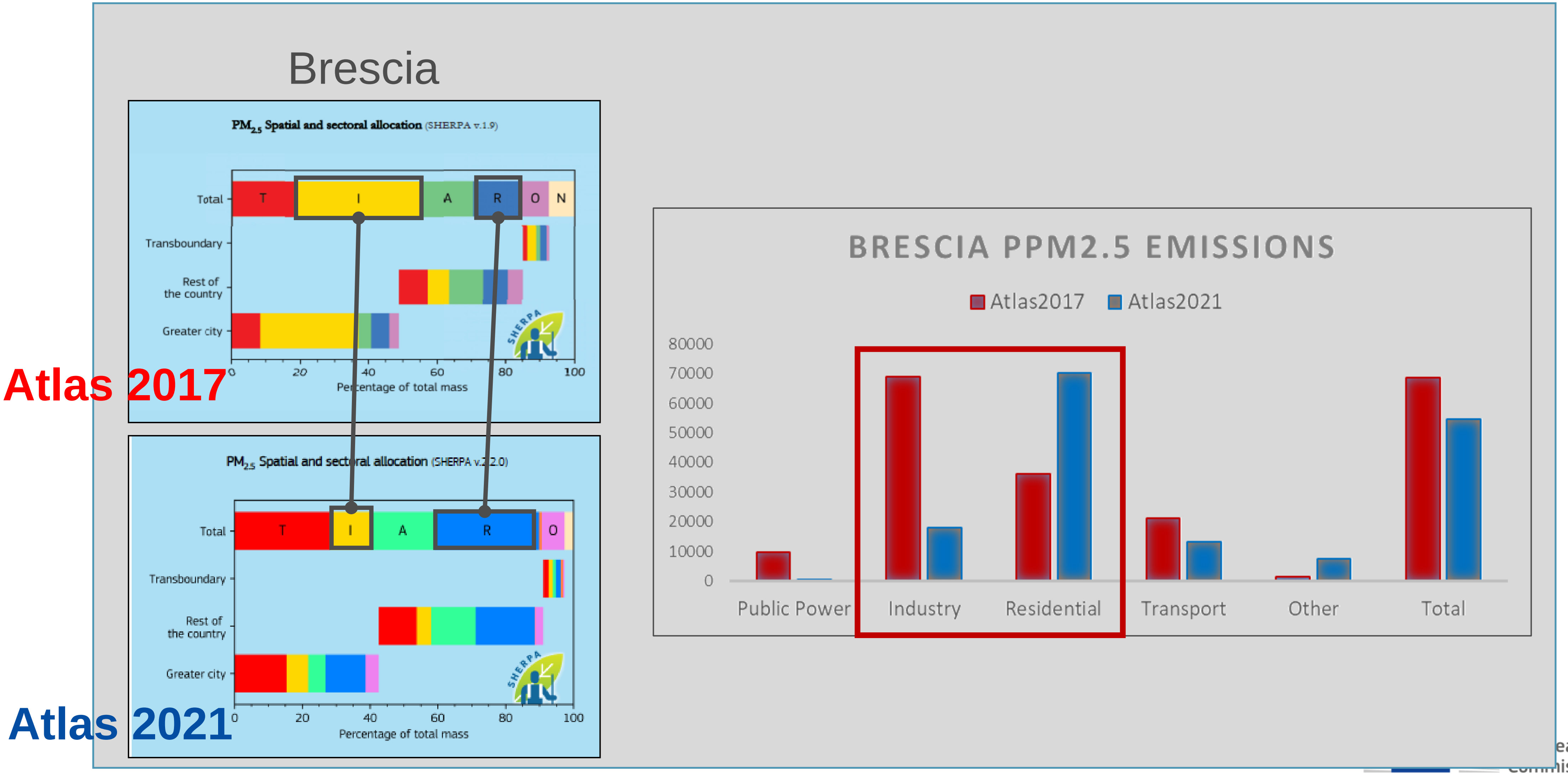


City fiches

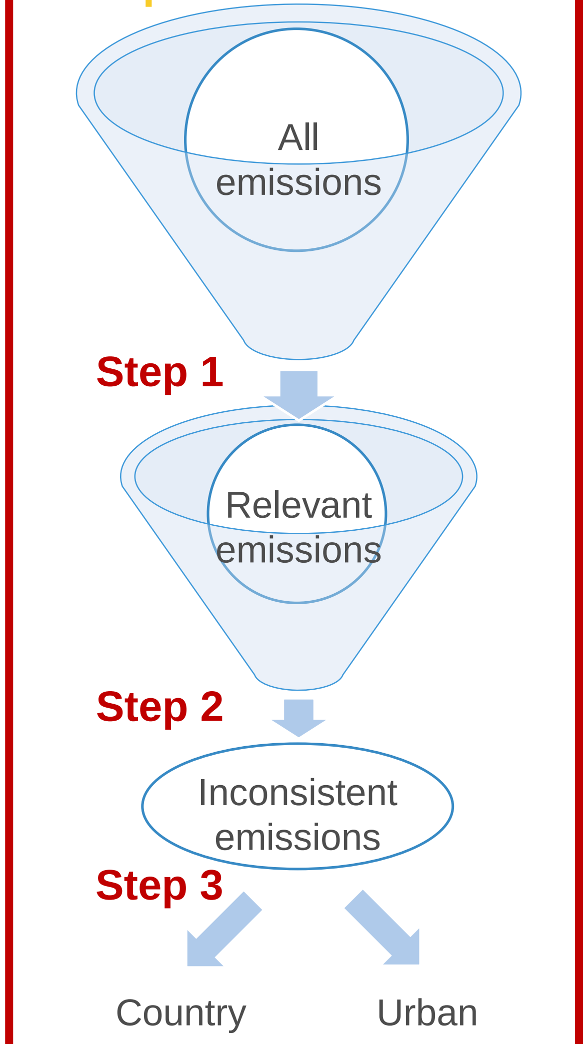

Germany, Berlin
Italy, Milan
Poland, Kraków
Yearly average urban background (2018)
PM2.5
PM10
Spatial and sectoral allocation (SHERPA v.2.2.0)
Emissions [kton/year]
Total
Transboundary
Rest of the country
Commuting Zone
City
Percentage of total mass
T - Transport
I - Industry
A - Agriculture
R - Residential
S - Shipping
O - Other
N - Natural
E - External
Greater city
City
104

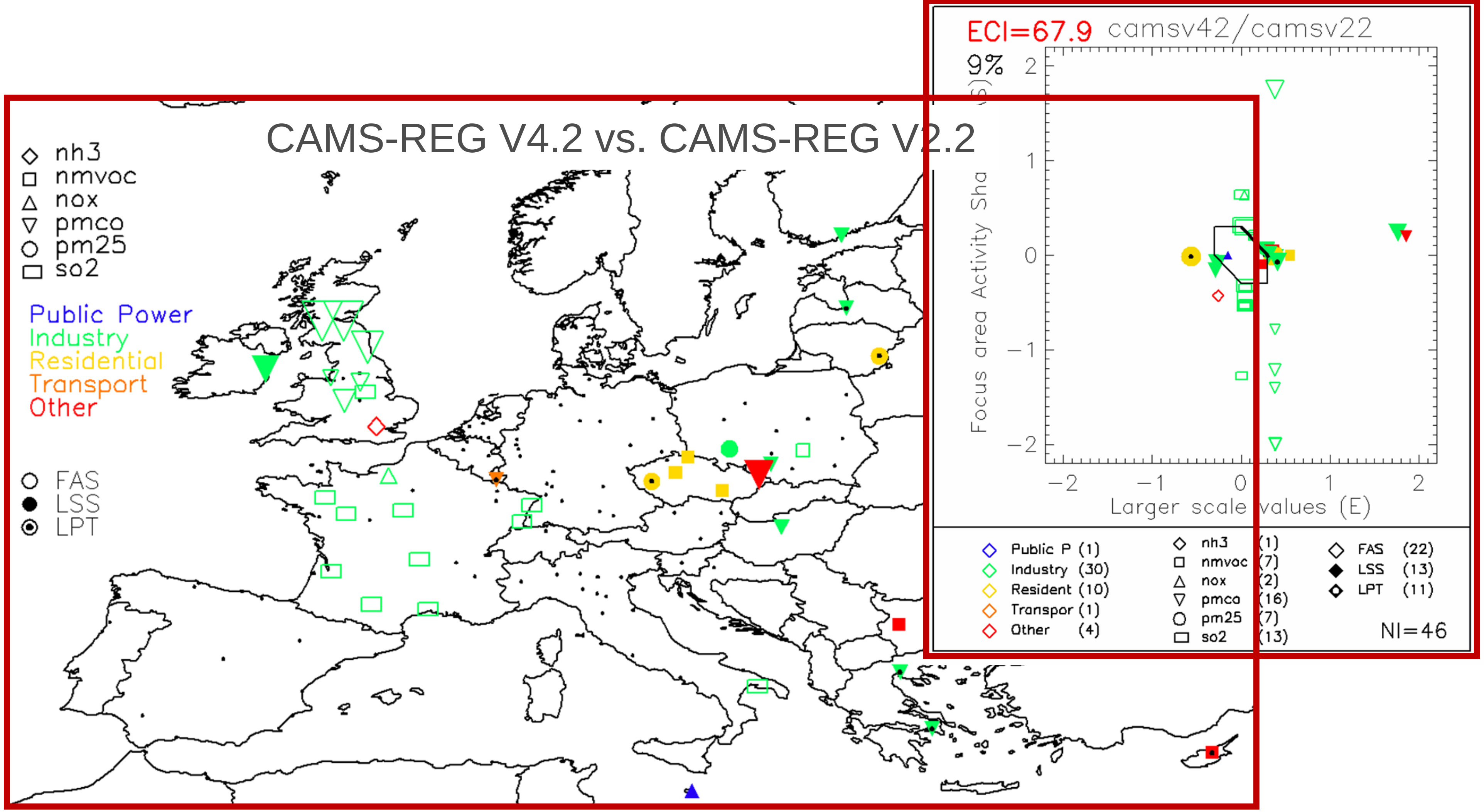

Belgium, Brussels
Greater City
Receptor Point
Antwerp
Lille
Charleroi
Namur
Pop [millions inhab]: 2.5
Area [km²]: 3 266
Yearly average urban background (2018)
PM2.5
PM10
EU
WHO
Measurements [µg/m³]
Histogram:
Number of stations
among the 150 cities
Above EU LV
Between WHO GL and EU LV
Below WHO GL
PM2.5 Spatial and sectoral allocation (SHERPA v.2.2.0)
Total
Transboundary
Rest of
the country
Greater city
Percentage of total mass
Emissions [kton/year]
PPM2.5
NOx
NH3
NMVOC
SO2
T - Transport
I - Industry
A - Agriculture
R - Residential
S - Shipping
O - Other
N - Natural
E - External
Greater city
5

Emission differences: implications for source apportionment



FAIRMODE QAQC screening approach

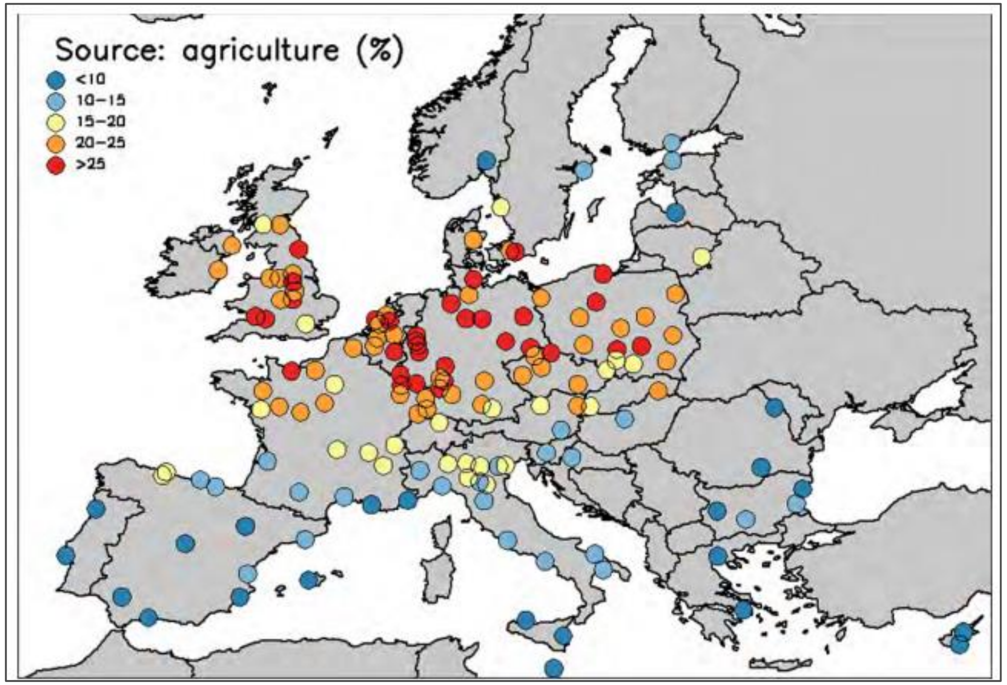




$PM_{2.5}$ Atlas main conclusions (I)

1. Target or key sectors and scales to abate air pollution are city specific
2. For many cities, sectoral measures addressing agriculture at country or EU scale would have a clear benefit on urban air quality.

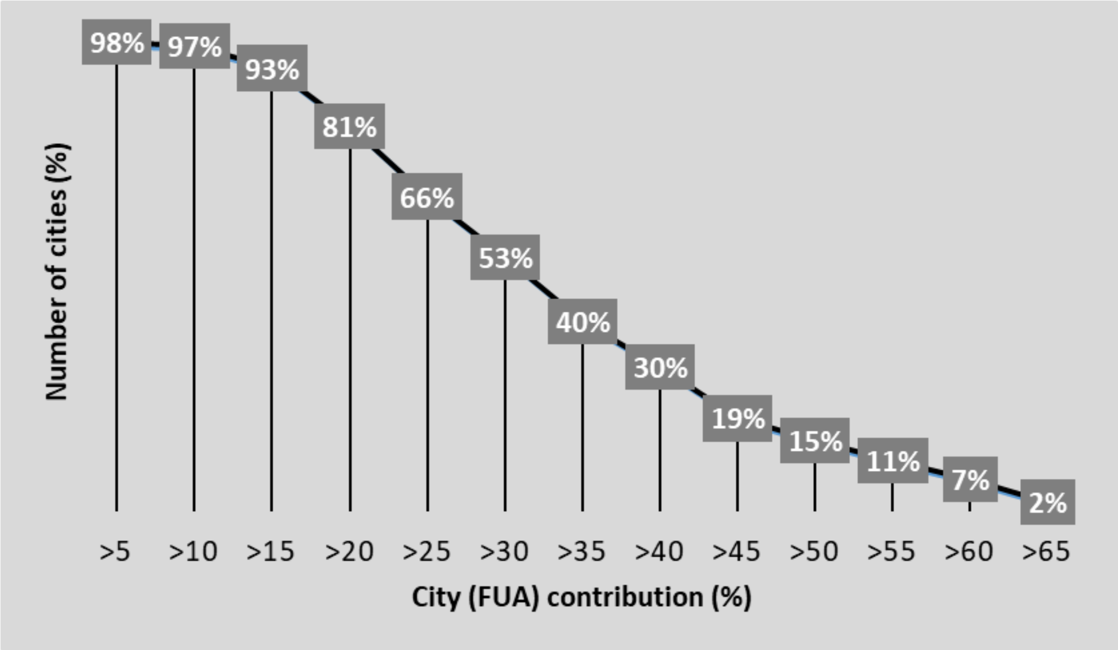
Agriculture contributes to more than 25% of the air pollution in about 20% of the cities and to more than 20% in 50% of them.



$PM_{2.5}$ Atlas main conclusions (II)

3. For many cities, local actions at the city scale are an effective means of improving air quality

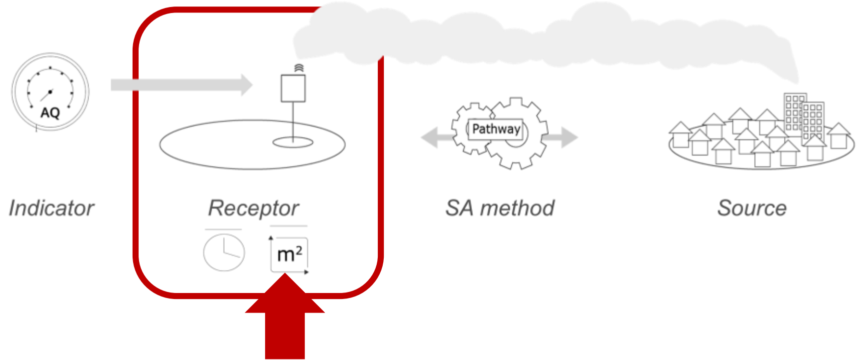
About 30% of the cities contribute to at least 40% of their pollution and about 50% contribute to more than 30%

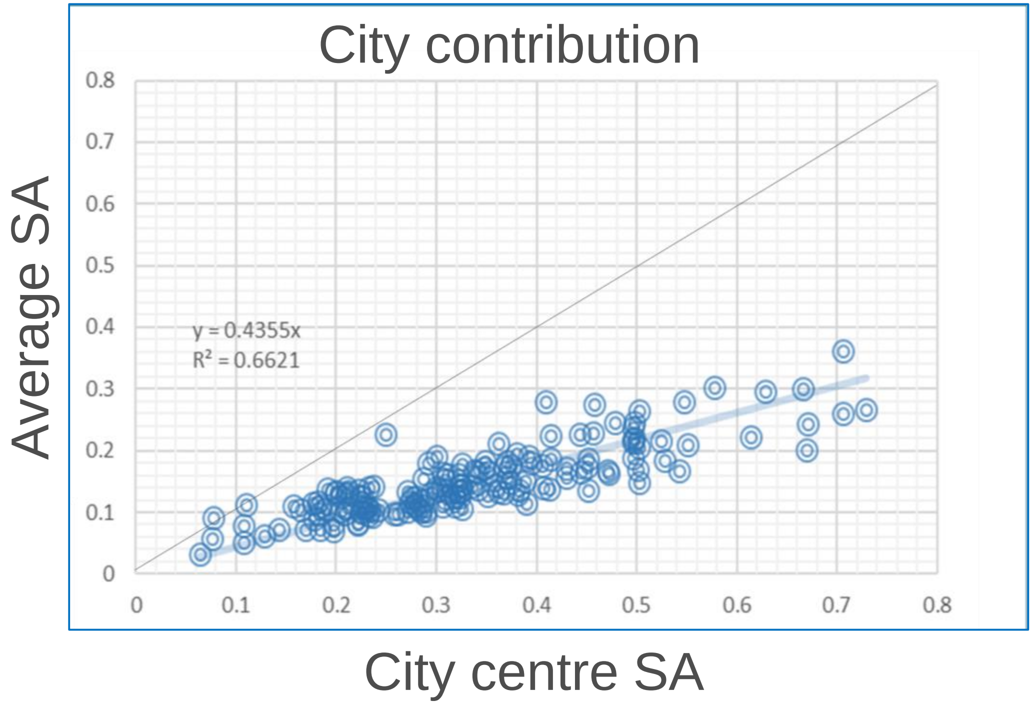


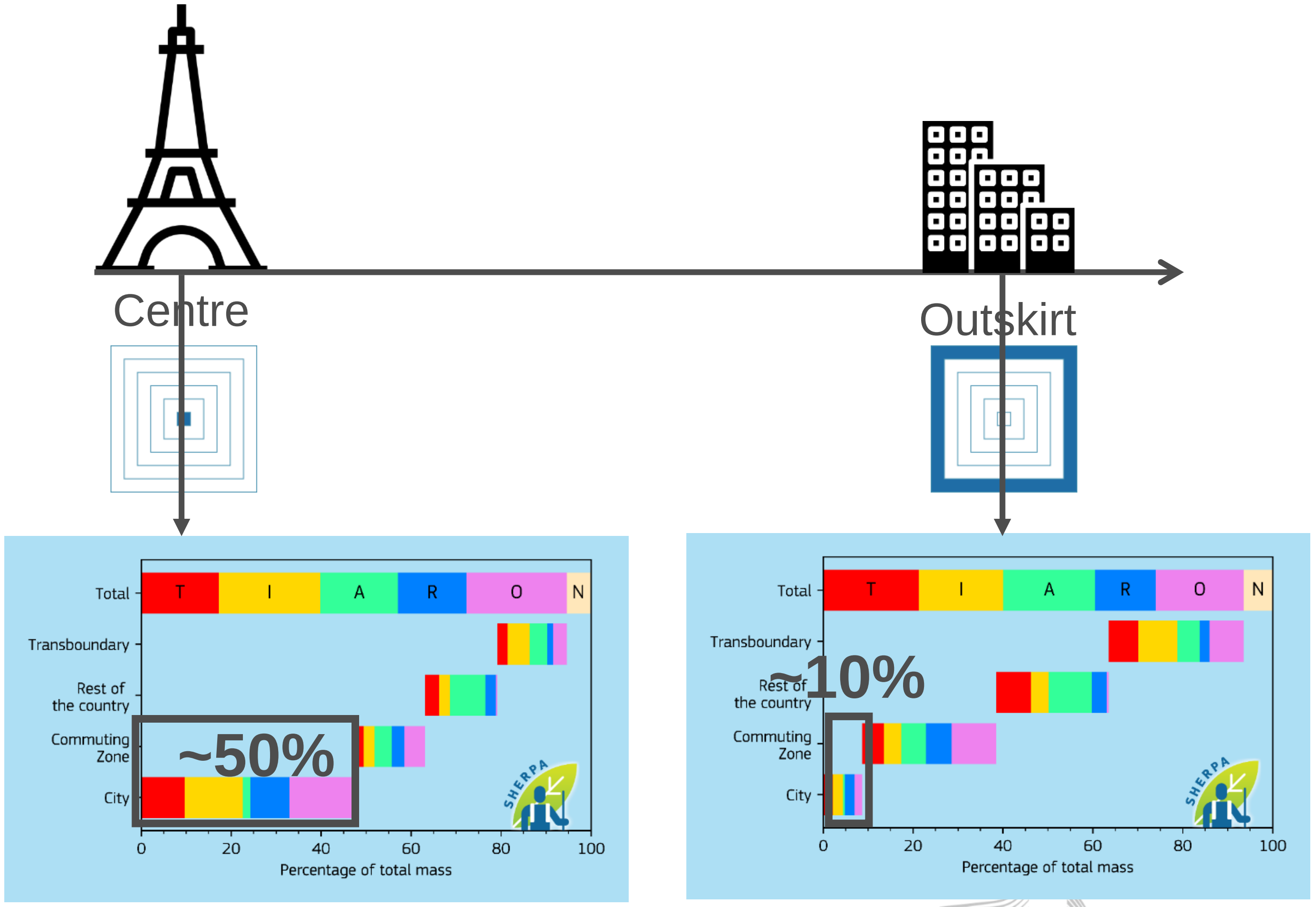
4. Because of methodological choices and assumptions, the responsibility of a city in generating its air pollution is often underestimated.

Why is the city's responsibility for its air pollution often underestimated? A focus on PM2.5.
Thunis P., Clappier A., de Meij A., Pisoni E., Bessagnet B., Tarrason L., ACP 2021

Spatial averaging at the receptor







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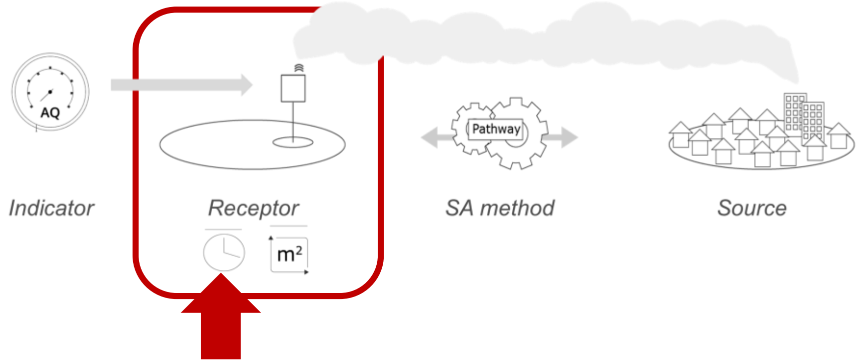
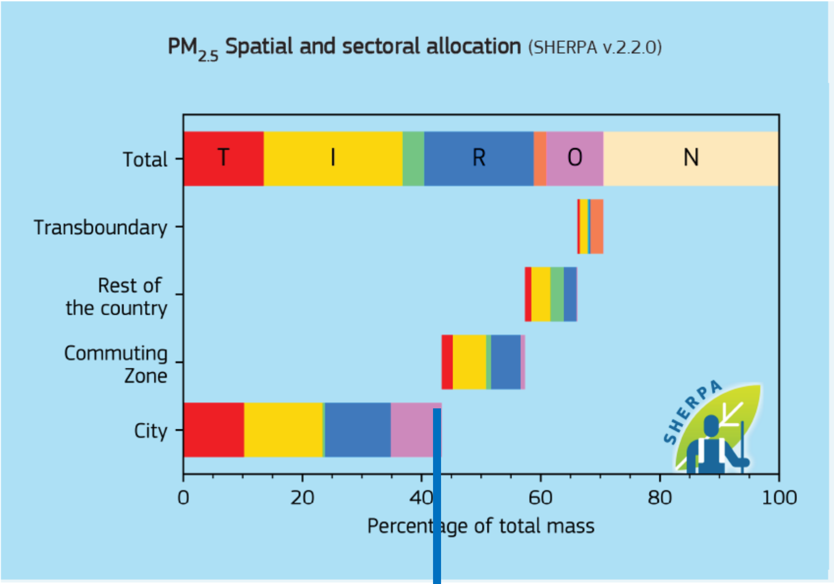
Temporal averaging at the receptor



A new methodology to evaluate the effectiveness of local policies during high PM2.5 episodes: application on 10 European cities. Pisoni, E., Thunis, P., de Meij, A., Bessagnet, B. : Submitted to Atmos. Chem. Phys., 2021



Year: 44%

Summer: 35%

Winter: 75%

Day: 90%

Conclusions

- The Atlas 2021 confirms the findings of 2017
  - Local actions are efficient in most cities
  - Abating agriculture emissions is an efficient way to improve urban air quality
  - City specificities must be considered when designing air quality plans
  - Methodological choices can often lead to underestimating the city responsibility on its air quality
- Emissions are the crucial input to source apportionment, but yet a very uncertain input. Hence the need to improve their robustness. (FAIRMODE QA/QC process)

Thank-you

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